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A Sensible Policy

The debate on the second reading of "Steel Bill" has aroused in the minds of ironfounders a sense of insecurity and bewilderment. The speech from the Throne had led them to believe that, whilst the iron and steel industry was to become a State monopoly, the ironfoundry was to remain under private ownership. When the contents of the Bill were made public, the ironfounder discovered that the Government were not taking over the iron and steel industry as a whole, but 100-odd firms plus their subsidiaries, which constituted in the aggregate a very high percentage. He later learnt that an "incidental" was the acquisition of further ironfoundries which, together with those already owned by the Government, would extend nationalisation to the total of 30 per cent. by weight of the industry's output. No doubt many ironfounders have seen the still incomplete list of goods now being made by the firms to be taken over. These items total up to well over 200, and include such things as baths, cisterns, copper tubes, fire lighters, furniture, ganister, golf shafts, housing societies, fencing, fertilisers, clay, creosote, kerbs, davits, disinfectant, gutters, glass netting, fur, hemp, toilet requisites, gas lamps, metal spraying, printing machines, pumps, rubber goods, sugar machinery, tennis rackets, toilet paper, umbrella frames, windmills, and aluminium goods. These goods and services are all being affected, to a greater or lesser degree according to the accident of their birthplace, by this unwanted Bill.

No wonder, then, when last week some 200 ironfoundry owners attending the Annual General Meeting of the Joint Iron Council, passed unanimously a resolution roundly condemning the provisions of the Bill. The members are pleased with policy of Joint Iron Council, the body linking the Council of Ironfoundry Associations with the Pig Iron Producers' Association. The Iron and Steel Board on its creation pressed the representatives of the ironfounding industry to produce a "plan" for reorganising itself so as to become more efficient. A new director, Mr. Kenneth Marshall, was specifically appointed to handle this problem. With the help of his executive committee, he succeeded in convincing the Board that it was not a "plan" which was needed but a "policy," and that he has put forward. This policy has the advantage of progressive permanence. It consists in the appointment of a panel in continuous session to examine ironfoundry efficiency under a dozen or more headings and to collect and collate the statistics of the industry. One of the results of this "Policy" was dealt with in this column last week. Thus it may be through the continuous survey of the efficiency of the units of the industry, plus encouragement by campaigning against unnecessary controls, that the J.I.C. will be able to report—not to the now non-existent Iron and Steel Board, but to the country at large—that as an industry the manufacturing of iron castings ranks amongst the most efficient.

Ironfounders much prefer that their "efficiency" policy should come from their own trade organisations rather than from working parties and the like. It cannot be stressed too strongly or too often that in the various employers' federations there are very few competitors, but instead there are friends in an ever-increasing number who are anxious to help fellow members to attain their natural ambitions in the efficient ownership or management of their businesses.

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Threat to Ironfounding Industry

At the Annual Convention of the Joint Iron Council, held in London last week, the producers and users of foundry pig-iron passed the following resolution unanimously:—

"That this Convention of the Joint Iron Council, which is fully representative of its two constituent members, the Council of Iron Producers and the Council of Ironfoundry Associations, which in turn are fully representative of the producers and users of every grade of foundry iron, records its unqualified opposition to the policy of the Government, as embodied in the Iron and Steel Bill now before Parliament. The Convention appreciate that ironfoundries in general are not included in the third schedule of the Bill, but as it is clear that if the Bill becomes law the production and distribution of all pig-iron will be entirely at the discretion of the new Iron and Steel Corporation, the Convention is unanimously of the opinion that the maintenance and development of an efficient and free ironfoundry industry will be impossible under these conditions. The Convention authorises its executive to take all legitimate steps to defend and protect private enterprise throughout every section of the industry and in particular to secure the rejection of the Iron and Steel Bill. Further, the executive committee is urged to take every possible step to bring home to all producers in the industry and to all the purchasers of its products the direct and indirect dangers which threaten the industry."

New Catalogue

Steel Fabrications. The Widnes Foundry & Engineering Company, Limited, of Widnes, have recently released a catalogue covering the products of their constructional steel department. The brochure is excellent from every viewpoint. The letterpress is well written and the illustrations have received just that correct amount of retouching which, whilst being unobtrusive, has eliminated extraneous matter and thrown the plant properly into relief. The cover is particularly pleasing, and the only query that arises here is, as to whether a completely geometric device would not be better than the existing irregularly shaped coloured patch for the firm's monogram. This point the reviewer discussed with the manager of the art department, who pointed out that by departing from a geometrical shape more attention was focused on the monogram W.F.E. which was probably the object sought by those responsible for the brochure. We congratulate the publicity manager of Widnes Foundry on the high standard he has achieved.

Pitch-bonded Sand

In answer to queries from several readers, the pitch pellets used by Mr. Bullock and Mr. Finlay in the experiments described in the article we printed on pages 481-82 of our issue of November 18, are manufactured by the Fordath Engineering Company, Limited, of Hamblet Works, West Bromwich.

Forthcoming Events

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

NOVEMBER 30.

The Institute of Metals.

South Wales Local Section:—"Observations on White Metals for Bearings," by Prof. H. O'Neill, D.Sc., F.I.M., at the University College, Swansea, at 6.30 p.m.

DECEMBER 1.

Institution of Production Engineers.

Preston Section:—"The Commercial Possibilities of the Lost Wax Process," by A. Short, at Clayton Goodfellow & Company, Limited, Blackburn.

Institution of Works Managers.

Leeds Branch:—"Production Planning," by D. G. Petrie, at 7 p.m., at the Great Northern Station Hotel, Leeds.

Manchester Metallurgical Society.

"Prevention of Corrosion," by F. Fancutt, F.R.I.C., and J. C. Hudson, D.Sc., F.I.M., at the Engineers' Club, 17, Albert Square, Manchester, at 6.30 p.m.

DECEMBER 2.

Institute of Vitreous Enamellers

Midland Section:—"Preparation of the Enamel," by A. Biddulph, at the Chamber of Commerce, New Street, Birmingham, at 7.15 p.m.

Leeds Metallurgical Society

"Recent Developments in Photo-elasticity," by J. Ward, Ph.D., B.Sc., at 7 p.m., in the Chemistry Department, The University, Leeds.

DECEMBER 3.

Manchester Association of Engineers

"The Gas Turbine for Industrial Power," by R. G. Voysey, at 6.45 p.m., at the Engineers' Club, 17, Albert Square, Manchester.

The Institute of Metals.

London Local Section:—Annual Dance. Details to be circulated to members.

DECEMBER 4.

Institute of British Foundrymen.

Wales and Monmouth Branch:—"Castings Inspection," by H. Williams, at the Engineers' Institute, Cardiff, at 6 p.m.

Industrial Management

From Bulletin No. 32, issued by the Council of Ironfoundry Associations, we cull the following information:—There is to be a second foundry management conference on Thursday, Friday and Saturday, May 3, 6 and 7, 1949. Moulders' safety boots are now not only coupon free, but also permit free. Other items to be similarly treated are oilskin clothing and industrial leather gloves. Sandblasters' suits are not yet released from control. There are more pictures available for borrowing for the embellishment of canteens. Finally, there is to be a short study course at the Royal Institute of British Architects on November 24 to 26 on the subject of "Colour and Lighting in Factories." Details are obtainable from the Council of Industrial Design, Tilbury House, Petty France, London, S.W.1.

Stoves on Show in Scotland

From December 20 until January 1, the Allied Ironfounders' exhibition train will lie in St. Enoch Station, Glasgow, with a varied display of stoves, cookers and open fires made by firms in this group, which includes seven iron companies in the Falkirk area. Already started on its nation-wide tour, the train will visit over 20 big centres. The display is meant primarily for members of housing authorities and their staffs, builders, and everybody connected with housing and furnishing.

Steel Castings for Aircraft*

By E. J. Brown, A.I.M. and F. Rodgers, A.Met., A.I.M.

(*Continued from page* 480.)

Faceted Fractures

In the early stages of mass production of alloy steel castings, whilst mechanical test requirements were in the vast majority of cases comfortably met, low ductility and Izod values were occasionally obtained, these clearly being associated with particular heats of steel. It was further noted that these low values corresponded with a coarsely crystalline fracture which, for the lack of a better description, is termed "faceted" (see Fig. 12). Whilst the Authors can find no reference to this experience in British literature, reference is made below to information from an American source, where it is referred to somewhat colourfully as "rock candy."

It was evident that these fractures were not the outcome of obvious variations in composition or incorrect heat-treatment and investigations were put in hand with a view to solving the problem.

An early approach made, which was directed towards determining the effect of eliminating the refining operation, was carried out in the basic arc-furnace. Approximately 1 ton of steel was taken from the arc-furnace at the stopping stage, that is, after the removal of the melting slag. This was poured into a basic-lined high-frequency furnace after first removing all the slag. The steel was in the high-frequency furnace for 1 hr. 35 min., the percentage of necessary alloy addition being the same for each of the respective quantities of steel. The quantity remaining in the basic arc furnace was approximately 2 tons. Clover-leaf test-bars were cast from each section, the analysis and Izod test results are shown in Table II.

It will be noted that the Izod values of the high-frequency portion are roughly half of those of the contemporary arc furnace, the provisional lesson being that the refining of the steel had conferred benefits rather than otherwise, it being apparent that the change in characteristic had been introduced after melting, the experiment thus eliminating any melting influence.

A critical examination of the processes involved, carried out with the object of finding a reason for the drop in values, appeared initially to be fruitless. One difference noted, however, was the addition of 0.10 per cent. of aluminium to the H.F. steel, compared with 0.04 per cent. to that tapped from the arc furnace. This fact, although seemingly slender, prompted a series of experiments designed to explore the effects of relatively small additions of aluminium.

A series of melts were made in an 18-lb. high-frequency furnace, using in each case scrap of the same composition as that normally used for the bulk production of low-alloy steels. As far as possible all conditions were standardised, except that aluminium was added in increasing quantities as detailed in Table III.

*Presented at the London Conference of the Institute of British Foundrymen, June, 1948.

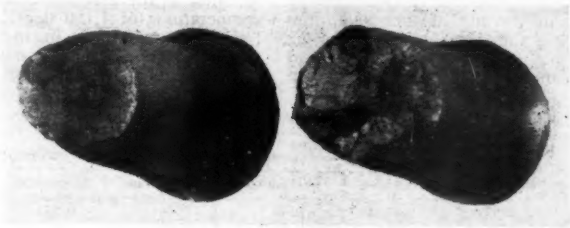


FIG 12.—FRACTURE OF TENSILE SPECIMENS. RIGHT, FACETED; LEFT, NORMAL.

TABLE II.—*Percentage Compositions of Steels from the Basic Electric and High Frequency Furnaces.*

	Carbon.	Silicon.	Manganese.	Sulphur.	Phosphorus.	Chromium.	Nickel.	Molybdenum.	Izod. (ft./lb.)			Brinell.
Arc ..	0.44	0.20	0.61	0.007	0.012	0.59	2.43	0.59	45	45	46	277
High frequency	0.43	0.28	0.61	0.014	0.015	0.69	2.46	0.61	23 24	24 25	26 26	269 285

Steel Castings for Aircraft

TABLE III.—*Influence of Aluminium Additions in the Impact Strength of an Alloyed Steel.*

Heat No.	Aluminium Added Per cent.	Izod ft./lb.	Average Izod.	Brinell.
0381 ..	Nil	33 33 34	33	321
0381/3 ..	Nil	32 34 30	32	311
0381/5 ..	0.02	25 27 30	27	311
0381/8 ..	0.05	28 26 27	27	321
0381/9 ..	0.10	22 21 21	21	311
0381/4 ..	0.20	20 21 21	21	311

The results of the Izod tests shown in Table III suggest a progressive deterioration in resistance to impact, such deterioration corresponding with increasing additions of aluminium in accordance with the values shown.

Practical Trials

As an outcome of the above findings increments of aluminium were made to quantities of steel poured from a bulk heat into hand shanks, the resultant impact tests being as follows:—

Aluminium per cent.	Izod Tests, ft./lbs.	Brinell.
0.06	30, 30, 28	302
0.10	26, 25, 25	293
0.20	21, 21, 21	302

The progressive decrease in values shown corresponding with increasing aluminium in general confirms the results indicated in Table II, it being thus assumed that the simple addition of aluminium was the cause of both low elongation and impact values. The obvious remedy was the discontinuance of the use of such quantities of aluminium likely to be of influence, and the following are records of the results obtained both before and after the changed procedure, all steels being treated to similar tensile values.

Per cent. deoxidant ..	Aluminium, 0.10 to 0.2	Al, 0.04, Ca-Si-Mn, 0.50
Number of Heats	30	22
Av. Izod, ft./lb.	21.3	32.9
Range „ „	5 to 36	21 to 46

The initial experiments recorded above, whilst establishing the adverse effect of aluminium in relatively small quantities, did not provide a key to the mechanism of the problem. Experience gained on the application of aluminium to relatively high-sulphur carbon steel and its beneficial effect could not, and in fact cannot now, be fully reconciled. This problem had been given some attention in America, and information was received which, after outlining parallel experiences, detailed a series of experiments and concluded that the decrease in mechanical properties was attributed to the intergranular presence of aluminium nitride which occurred in the primary austenitic grain boundaries. A further American source of information on the subject to which the Authors would draw attention is contained in a paper by Dr. C. H. Lorig.[2]

The general conclusions reached by Dr. Lorig are:—

(*a*) Alloy steels become increasingly susceptible as (i) the aluminium content is increased, (ii) the nitrogen content is increased, and (iii) the rate of cooling is decreased.

(*b*) less than 1 lb. of aluminium per ton of steel could be tolerated in steel having an intended content of 0.015 per cent. cooled at 16 deg. C. per hour, whilst with the same nitrogen content, castings of ½-in. section cooled in the mould were free from defects although containing 2 lb. of aluminium per ton.

(*c*) With a cooling rate of roughly 56 deg. C. per hour, precipitation was found to occur at 816 deg. C. and solution of the precipitate was effected by reheating to temperatures of 1,150 deg. C. and higher.

(*d*) From rather inconclusive evidence obtained, titanium and zirconium additions, by reason of their powerful nitride-forming characteristics, were found to effect a partial recovery of properties.

TABLE IV.—*Composition of Experimental Test Heats.*

Heat No.	Composition.							Casting Temperatures (Immersion).
	Carbon.	Silicon.	Manganese.	Chromium.	Molybdenum.	Aluminium.	Nitrogen.	
0667 ..	0.27	0.63	1.53	0.46	0.60	0.27	0.011	1,575 deg. C.
0667/2 ..	0.25	0.38	1.58	0.46	0.51	—	0.010	1,590 „
0667/3 ..	0.26	0.53	1.50	0.52	0.60	0.41	0.003	1,580 „
0667/4 ..	0.26	0.48	1.36	0.53	0.58	0.03	0.006	1,580 „

TABLE V.—*Tensile Tests on Clover Leaf Bars Cast from the Surplus Detailed in Table IV.*

Heat No.	Aluminium, per cent.	Nitrogen, per cent.	Yield Point, Tons per sq. in.	Max. Stress, Tons per sq. in.	Elongation, per cent. on 2 in.	Reduction of Area, per cent.	Brinell.	Fracture.
0667 ..	0.27	0.011	55.6	71.6	5	10	321	50 per cent. faceted.
0667/2 ..	—	0.010	50.0	68.4	15.0	35.5	321	Fibrous.
0667/3 ..	0.41	0.003	48.0	58.5	3.0	1.5	331	100 per cent. faceted.
0667/4 ..	0.03	0.006	50.0	70.8	16.0	43.5	323	Fibrous.

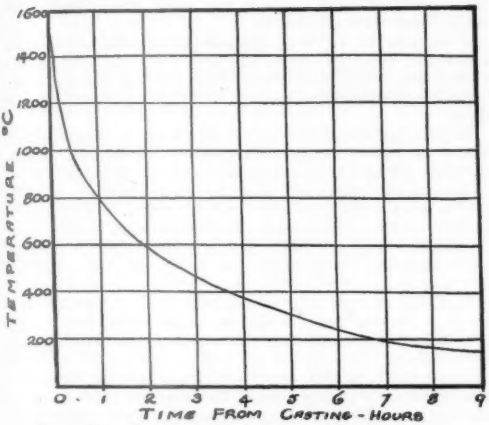


FIG. 13.—COOLING CURVE FOR CLOVER-LEAF TEST-BAR CASTING.

With the object of verifying the American findings some further experimental work was put in hand. Four heats of steel were made in the 18-lb. H.F. furnace to the composition given in the American report, with additions of aluminium (at the rate of 8 lb. per ton) and nitrogen at 0.01 per cent., both separately and together. Clover leaf test bars were cast for the investigations. The composition of the test bars is given in Table IV.

Cooling Rate

The rate of cooling (see Fig. 13) was determined by means of a thermo-couple introduced into the lower portion of the feeder head of the first casting made. The speed of cooling was relatively fast (56 deg. C. per hour), and, accepting the premises of the report, would tend to lessen the formation of the faceted structure, but this can be taken as a representative of normal conditions for this mass.

Heat-treatment

The clover-leaf bars were sectioned and one wing of each subjected to the following heat treatment, 1,010 deg. C. in air, 900 deg. C. in water, and 580 deg. C. in air. Tensile tests carried out on the treated bars are shown in Table V.

Effect of Homogenising

The details shown in Table VI relate to an experiment designed to determine the effects of homogenising. A relatively poor test was obtained from a test bar, the fracture being faceted. A remaining wing was subjected to high temperature treatment (1,100 deg. C.) followed by a normal quenching and tempering.

Further experience has shown that this treatment (B) is not fully effective in cases where "faceting" is severe.

TABLE VI.—*Effect of Homogenising.*

Composition: Carbon, 0.22; silicon, 0.62; sulphur, 0.010; phosphorus, 0.017; manganese, 0.60; chromium, 1.03; and molybdenum, 0.21 per cent.

Treatment: A. Quenched from 910 deg. C. in water and then from 555 deg. C. in air.

Mechanical Tests:

0·10 per cent. Proof Stress	Max. Stress, Tons per sq. in.	Elongation, Per cent.	Reduction in Area, Per cent.	Izod ft. lb.	Brinell Hardness.
45.4	62	8.0	13.6	30, 35, 36	285
45.0	62	8.0	10.0	—	285

Fracture faceted.

Treatment: B. Heated to 1,100 deg. C., quenched from 900 deg. C. water, and from 550 deg. in air.

Mechanical properties:

0·10 per cent. Proof Stress	Max. Stress, Tons per sq. in.	Elongation, Per cent.	Reduction in Area, Per cent.	Izod ft. lb.	Brinell Hardness.
41.4	58·8	13.0	29.2	39, 41, 43	255

Fracture not faceted.

Microscopical Examination

Sections of the tested specimens were examined microscopically after a normal nital etch and after a deep etch, the results being given below.

(*a*) *Nitrogen Bearing Steels* 0667 *and* 0667/2.

The miscrostructure consisted of acicular tempered martensite (sorbite) with inclusions more numerous in

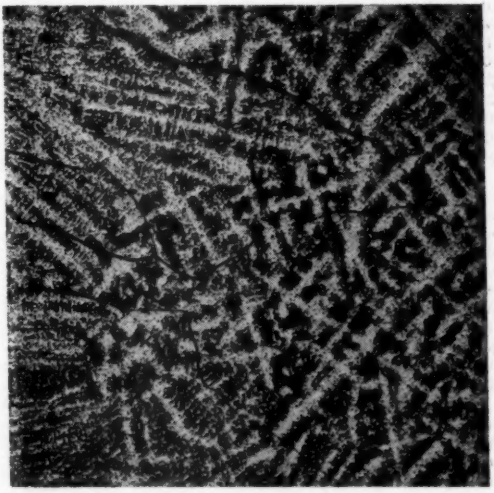


FIG. 14.—EFFECT OF DEEP ETCHING BY ACID ON THE STRUCTURE OF SPECIMEN 0667.

the aluminium-bearing steel (0667) than the other. Neither specimen showed grain boundary inclusions. Deep etching revealed numerous grain boundaries on specimen 0667 (see Fig. 14), the grain size being of the same order as that indicated by the facets of the fracture. No such boundaries were developed by this method on the aluminium-free steel (0667/2).

(*b*) *Low Nitrogen Steels* 0667/3 *and* 0667/4.

No pertinent differences were shown by the nital etch. Examinations at the highest magnification obtainable on a bench microscope (× 1,750) failed to reveal any grain boundary inclusion of the aluminium-nitride type. Deep etching showed boundary outlines on 0667/3 (aluminium-bearing) but not on 0667/4 (aluminium-free).

Theoretical Considerations

The primary function of aluminium addition to steel is to serve as a de-oxidant, the reaction being represented by the following equation:—

$$2\ Al + 3\ FeO = Al_2O_3 + 3\ Fe,$$

the heat of formation of Al_2O_3 being 380,000 calories approx.[2] It is also known that aluminium has a strong affinity for nitrogen, the equation governing the reaction being:—

$$2\ Al + N_2 = 2\ AlN,$$

the heat of formation in this case being 70,000 calories, approximately.

Analysis of the above equation in conjunction with the heats of formation reveals that the aluminium oxide will be formed in preference to aluminium nitride, but it is evident that the amount of aluminium necessary to satisfy both reactions is relatively small in view of the quantities of oxygen and nitrogen encountered in modern steel-making practice. The affinity of aluminium for iron cannot be disregarded, but according to Schenck nothing is known regarding the heat of formation of such compounds.

It is also realised that the quantity of iron oxide in basic arc steel is very variable, the residual amount being influenced by melting conditions and the final carbon percentage. Based, however, on the assumed quantity of 0.10 per cent. FeO, it is found that approximately 0.025 per cent. of aluminium would be required to satisfy its requirements. The amount of aluminium added to the heats of steel made for castings and from which faceted fractures were occasionally found, was 0.10 per cent., thus leaving a residue of about 0.075 per cent. available for combination with other elements, including nitrogen.

It may, therefore, be assumed from the above consideration that approximately 0.04 per cent. aluminium should satisfy the chemical demands both with regard to nitrogen and oxygen normally found in the class of steel to which reference is made, and that any quantities in excess are theoretically superfluous. From the experience gained, no faceted fractures were found when the aluminium was kept to the lower levels, but only when these were exceeded.

Reference to Table V reveals that a steel containing 0.003 per cent. nitrogen, together with 0.41 per cent. aluminium, exhibits a completely faceted fracture, despite the comparative freedom from nitrogen contamination.

Regarding the influence of sulphur, it would seem that this element in significant amount would be potent in neutralising any effect resulting from the presence of comparative excess of aluminium by reason of the well-known affinity of the two elements. The steels quoted in this Paper were for the most part very low in sulphur content (0.005 to 0.015 per cent.), its influence therefore being more or less a matter of conjecture.

The faceted type of fracture described may be likened to that shown when steel is overheated or burnt, although it is obvious that entirely different mechanisms are involved.

The affinity of titanium and zirconium for nitrogen is well known, and it would be expected that suitable additions of either of these would act as a corrective. According to Lorig, experimental evidence does not indicate a marked suppression of the condition when these elements are added. He suggests, however, that when either of these was introduced, and thus replaces an equivalent amount of aluminium, the susceptibility of the steel to the formation of the intergranular fracture is reduced. The question would appear to be, is this effect due to the reduction of aluminium *per se*, or to any reaction with nitrogen which may be present? The results obtained from the experimental work outlined in this Paper would suggest the former.

The beneficial effects quoted from the homogenising treatment carried out, strongly suggest the existence of an intergranular constituent capable of being diffused at high temperatures and re-precipitated in a dispersed form on cooling. Such a method of correcting the trouble is hardly practical by reason of the excessive amount of scaling which takes place. The above reasoning would lead to the conclusion that nitrogen is only, at the most, a secondary factor in the formation of the very undesirable structure described.

In summarising the experiences gained in the manufacture of castings suitable for aircraft, the Authors trust that they have contributed in some measure to the solution of the problems involved. Regarding faceted fractures, whilst a relatively simple means for the avoidance of these is proposed, they fully realise the absence of a comprehensive theory regarding the phenomenon and suggest the desirability of a fundamental investigation into the problem.

The Authors are indebted to the directors of Hadfields, Limited, for permission to publish this Paper, and in particular to Mr. E. W. Colbeck, M.A., F.I.M., metallurgical director, and a number of their colleagues for helpful suggestions.

REFERENCES.

2 C. H. Lorig, "Causes and Prevention of Intergranular Fracture in Cast Steel." Proceedings of Electric Furnace Steel Conference (U.S.A.), 1945, p. 234.

3 Hermann Schenck, "Physical Chemistry of Steelmaking," p. 217

DISCUSSION

MR. C. H. KAIN (Past-President, London Branch) said that in congratulating the Authors on a real foundrymen's Paper he was paying them a very high compliment. He asked for an exact definition of "collapsible green cores," for green moulding sand cores were not normally considered collapsible. Commenting that there was no reference in the Paper to the fettling of the castings, he said that fettling was a very important steel-foundry operation, much more important than in most other sections of the foundry industry, and he asked for further information with regard to it. Were difficulties experienced due to surface cracks or cracks of any form after flame cutting, had it been necessary to abandon flame cutting and to use mechanical means, and was there any surface cracking after grinding and the normal fettling process?

Expressing particular interest in the results obtained from the clover-leaf test piece, he asked what were the dimensions of the test-piece the Authors had used. Their conclusion that the best results were obtained away from the equi-axed structure agreed with that of previous workers, and he suggested that in a special application such as that discussed in the Paper, using that type of test-piece, they should ensure that it was suitable for the section of the castings. For such very special castings he felt they would be justified in designing a special test-piece of appropriate dimensions which would give the dendritic structure throughout.

He was amazed to read that the quantity of iron oxide in basic arc steel was very variable. Surely, he said, of all processes that was the one in which the iron oxide content should be something like a constant; and he asked for further information on the matter.

With regard to the faceted fracture, he asked if it were found only in the high-tensile steel or whether the same phenomenon had been experienced when using carbon steels or lower-tensile steels; in his own experience it occurred occasionally in carbon steels. He did not feel competent to discuss that aspect very thoroughly without reference to the quite considerable work published in recent years on the aluminium dosing of steel, one of the virtues of which was a considerable increase in the impact values of steel. No doubt the Authors had considered that, and he invited them to enlarge a little on the difference between the effect of aluminium discussed in the Paper and the effect of aluminium dosing which was done deliberately to improve the impact values of the steel.

Fettling Methods

MR. BROWN, replying, agreed that perhaps the reference to green-sand cores sounded parodoxical, but the composition of the sand was given on the second page of the Paper. The cores were simply air dried and the increased value in crushing strength as a result were given in the Paper. With regard to fettling, in the case of the rear spar heads were sawn off, but in the case of the pivot brackets they were burnt off, obviously due to the very critical tests for the detection of minor cracks, sawing was preferable but not always practicable.

FeO in Basic Arc-melted Steel

MR. RODGERS, dealing with the question concerning the FeO content, said that candidly they were rather dubious about the values obtained and had decided ulimately to use the figure of 0.10 per cent., for that did not necessarily represent Hadfield's practice, but it was a fairly average figure obtained. No doubt it would give rise to some comment by Dr. Lorig in America.

MR. KAIN said he was making the point that the iron oxide content of basic arc steel was stated to be very variable, and he felt that that should not be so in modern arc furnace practice.

MR. RODGERS said he felt Mr. Kain would agree that the FeO content varied with the oxidation of the bath, and also the carbon content. It was true that aluminium dosing was applied to forgings for the purpose of improving impact values. The Authors, however, did not apply it as good practice for castings. The main purpose of the additions was to secure a fine grain; it was generally accepted that a fine-grained steel gave an Izod value superior to that of a coarse-grained steel for a given tensile strength.

As to the clover-leaf test-bar, he said that shown in Fig. 1 was full size, for one leg of the clover-leaf. The problem of representative section was rather difficult because in the rear spar casting particularly, one had to deal with variations of sections. For instance, the legs of the rear spar had a section of about 1½ inches, whereas the channel section of the rear spar was of about ¾ inch. The matter was taken up with the Air Ministry, who had approved of the particular type of test described in the Paper as being a routine acceptance test and allowances were made for the difference in mass. That was dealt with in the Paper.

Faceted Fractures

MR. KAIN asked whether the faceted fracture had been encountered in other than the high-tensile steel referred to in the Paper.

MR. RODGERS said they had encountered in isolated instances a very peculiar "woody" type of fracture in carbon steel. The matter was still in course of investigation; but is was felt at Hadfield's that it could not be termed a faceted fracture.

MR. R. J. RICHARDSON said that he knew little about the "rock candy" fracture, but a fracture of similar appearance was sometimes experienced in his foundry's production. Such a fracture could not be influenced by an excessive aluminium content as additions were strictly controlled at a figure below that suggested by the Authors. He had found it most liable to occur in the low carbon steels having a manganese content above 1.2 per cent. and also in 0.03 per cent. carbon steels with the manganese content below 1.2 per cent. He mentioned that as possibly an idea for further research.

MR. RODGERS replied that the Authors had never experienced any peculiar types of fractures in the low-carbon high-manganese steels. When he had stated, in reply to Mr. Kain, that they had experienced a very peculiar fracture in a carbon steel he was thinking of

Steel Castings for Aircraft—Discussion

a steel of 0.2 per cent. carbon and about 0.6 per cent. manganese—an ordinary 28 to 32 tons per sq. in. tensile steel. Dr. Lorig had stated his conclusion, in one of his Papers on the subject, that various alloying elements had some effect on the susceptibility of cast steel to that type of fracture. He was afraid, however, that the information available to Mr. Brown and himself was not sufficient to enable them to answer Mr. Richardson's question. Dr. Lorig had found that chromium steels in particular were very prone to that type of fracture. He added, in regard to the type of fracture they had encountered in low-carbon steel, that there was a very low elongation and the fracture somewhat resembled that of hardened tool steel.

Effect of Aluminium

MR. BROWN, commenting, thought that there was a little confusion with regard to the effect of aluminium. Most steelfounders were aware of the effect of aluminium on carbon steel as related to the sulphur content, the details of which were made public by Sims and Dahle some years ago. It was shown that the addition of an excess quantity over that demanded for deoxidation avoided the formation of a grain boundary type of constituent which naturally affected the ductility, thus with carbon steel additions aluminium could definitely impart improved properties. With regard to alloy steel of the chrome-molybdenum type mentioned in the Paper, the exactly opposite effect was encountered, aluminium in excess being found to produce the faceted fracture with a consequent serious effect on properties. Thus a very fascinating problem was presented.

MR. A. PEARSON asked if it were the Authors' opinion that the difference mentioned as between basic arc and high frequency steels, so far as the impact value was concerned, was due entirely to nitrogen. In other words, if they had a basic arc steel with a high nitrogen content, would they still find the "rock candy" fracture?

MR. BROWN recalled an experiment the Authors had made in the early stages, when they had melted a heat in the arc furnace and had then taken off half of it and put it into the high frequency furnace. The properties of the arc furnace heat were quite normal, *i.e.*, the melt had been subject to hydrogen pick-up. The portion put into the high frequency furnace and to which aluminium was added had given very poor mechanical test results. That experiment suggested that hydrogen was not the cause of the phenomenon.

MR. J. H. PEARCE (Sheffield) said the Authors in the second part of their Paper had certainly brought to light problems in connection with which, apparently contradictory results had been obtained from time to time, and he suggested that the subject was one on which the Institute's Technical Council might well start a series of investigations with a view to helping the foundrymen.

Core Sands

MR. H. E. CRIVAN referred to the weak core sands which the Authors had used, and he asked if they had experienced troubles with cores made of that type of sand.

MR. BROWN replied that they had to a certain extent; the cores were so delicate and fragile that occasionally they broke into two pieces. When they had started to make the pivot bracket the chief trouble experienced was the occurrence of tears at the junction of the torque tubes; they had tried various sand conditions until finally they had arrived at the very friable type of sand referred to in the Paper.

MR. N. D. RIDSDALE asked whether the sand test-pieces were the usual A.F.A. 2 in. diam. × 2 in. section, and how the air drying of the sand was effected. He presumed that each testpiece was rammed and then exposed to ordinnary air for the time stated, and tested immediately.

MR. BROWN agreed that the usual A.F.A. test-piece was used, and said that it was dried in the ordinary atmosphere at atmospheric temperature.

Written Contributions

DR. C. H. LORIG (Research Supervisor, Battelle Memorial Institute, U.S.A.) wrote:—

It was a pleasure to have an opportunity to review the Paper and he was, of course, extremely interested in the fact that the Authors had observed the intergranular type of fracture in cast steels treated with relatively high percentages of aluminium, particularly since such observations corroborated earlier findings.

In the Battelle studies of the influence of aluminium on the notch-bar properties of normalised cast steel, there had not been observed the degree of deterioration in resistance to impact that was shown in Table III of the Paper. Instead, with unalloyed 0.26 to 0.31 per cent. carbon cast steels, in which the sulphur content was below 0.02 per cent., no significant reduction in Izod value was observed with additions of aluminium up to around 0.25 per cent. It was personal practice with experimental high-frequency melts to withhold the aluminium addition until the heat was ready to pour so as to minimise variations in aluminium recoveries from one heat to the next. Furthermore, the heats required no more than thirty minutes for melting and refining. This short heat time tended to maintain the nitrogen content of the steel at a low level. Was it possible that the melting and heat-treating practices followed in the two laboratories were sufficiently different to account for the difference noted as to the effect of aluminium additions on notch-bar impact values? It was a matter of interest as to whether the nitrogen content of the steel dealt with might not be responsible for the seemingly detrimental effect of increased amounts of aluminium. Perhaps the Authors might wish to re-examine the specimens of Table III with the nitrogen content in mind.

Reply

In reply the Authors wrote that they were very pleased to receive the comments from Dr. C. H. Lorig,

from whose work much inspiration was obtained. Since the publication of their Paper they had been very interested to receive a further A.F.S. paper entitled "Occurrence of Intergranular Fracture in Cast Steel," by C. H. Lorig and A. R. Elsea, which dealt further with the problem of low ductility and shock values.

The Authors agreed with Dr. Lorig that associated with faceted conditions there were definite indications of grain boundary weaknesses (Fig. 14), but their investigations have not clearly shown these to be aluminium nitride. Further, the Authors contended that progressive increases in residual aluminium, even with nitrogen as low as 0.003 per cent., would effect a corresponding reduction in physical properties. It was agreed that with unalloyed steel containing sulphur of 0.02 per cent. no such effect would be encountered. The simple remedy was, of course, that makers of alloy steel castings should avoid relatively large excesses of aluminium, in fact other well-known deoxidants should be used with advantage.

The D.T.D. Specifications

MR. J. F. B. JACKSON wrote:—

It was somewhat remarkable that in a Paper dealing specifically with steel castings for aircraft no reference of any kind should be made either to the two most important relevant material specifications that have so far been issued, *i.e.*, D.T.D. Specifications 666 and 705, or to the exceptionally high standard of inspectional procedure which applied to aircraft steel castings required by these specifications.

While to aircraft engineers and metallurgists steel castings of the D.T.D. 666 and D.T.D. 705 class were now so generally known that this omission from Paper No. 902 would at once be apparent, the lack of reference by the Authors to the specifications in question and to all they implied from a technical standpoint, might well be distinctly misleading to both steel founders and engineers outside the aircraft industry.

It might not for instance be generally appreciated by the latter that high tensile aircraft steel castings produced in full accordance with D.T.D. 666 and D.T.D 705 had for some years now been utilised in air-frame and undercarriage constructions and have been stressed to an extent directly comparable with that which would obtain were steel forgings of similar tensile strength employed instead.

Moreover, unless produced in compliance with D.T.D. 666 and D.T.D. 705, steel castings for use in aircraft would normally be stressed to an extent considerably below that permissible with steel forgings of corresponding nominal tensile properties, thus incurring in most cases a substantial weight penalty.

It can only be presumed from the Paper that it was to this latter category of steel castings used in aircraft that the Authors were in general referring, particularly as the tensile strength requirements quoted (40/60 tons per sq. in.) were not comparable with the high range covered by D.T.D. 666 and D.T.D. 705, *i.e.*, 60 to 82 tons per sq. inch.

Reply

In reply the Authors wrote thanking Mr. Jackson for his contribution. Whilst they were fully aware of the two specifications mentioned, they pointed out that neither of the castings featured was made to either of these. As a matter of fact when the castings were projected the specifications quoted by Mr. Jackson were not in existence, D.T.D. 705 actually becoming operative in June, 1947.

In presenting this Paper the Authors had attempted to give an over-all picture of production details and the methods employed to overcome a number of difficulties. To meet various mechanical values from a test-bar was one thing, whilst to translate these into a complicated casting was another. In this respect the proof loading test detailed in the Paper carried out on the rear-spar, which was devised to simulate service conditions, would appear to give a much better guarantee of properties than those which might be interpreted from a test-bar.

House Organs

Zinc Bulletin No. 5. Published by the Zinc Development Association, Lincoln House, Turl Street, Oxford.

This issue shows a marked improvement over the earlier bulletins. It is better illustrated, and it covers a wider field in a much more interesting manner. Moreover, it does this without sacrificing any of the features regularly incorporated. The making of the Gestetner Duplicator is an article of real worth, which is well supported by others dealing with quite congenial topics.

The L.M.F.A. Bulletin No. 5.—The Light Metal Founders' Association Bulletin (No. 5) has rightly struck some aggressive notes. Outstanding are articles by Mr. A. Graham urging a more realistic attitude towards potential sales for light alloy castings, and by Mr. A. P. Fenn on aluminium-alloy cylinder heads. Failures, he points out, are usually due to the use of unsuitable alloys. After quoting specifications recommended, he advocates anodic treatment as being worthwhile. The Development Committee in their Report make the following interesting comment on the potentialities of vitreous enamelled finishes:—"The position at the moment is that there is already available a vitreous enamel finish for light alloys which is suitable for a number of applications. At the moment, however, this vitreous finish has to have a lead base which makes it unsuitable for use in conjunction with food products, and also impairs its resistance to moisture. There are already indications, however, that it may be possible to develop vitreous enamel free from lead, and it is in this direction that the A.D.A. Committee will be working in conjunction with other interested bodies."

VERMICULITE, a light-weight insulating mineral entity, is now being processed and marketed in this country by Dohm, Limited, of 167, Victoria Street, London, S.W.1.

Book Review

The Development of the Metal Castings Industry. By Bruce L. Simpson. Published by the American Foundrymen's Society, 222, West Adams Street, Chicago, 6, Illinois, U.S.A.

The Author, who is a past-president of the American Foundrymen's Association, in some 150 well-illustrated pages, has done ample justice to a difficult subject. Only too often one finds, in works of this character, that too great a stress is given to national development as distinct from international. Mr. Simpson has indeed held a fine balance. He writes well and has chosen his illustrations with such care that each contributes something to the subject—a historic casting, mould or mechanism, or an artistic masterpiece. Some are both, as, for instance, his picture of the oldest known casting in existence—a cast copper frog surmounted by a long stalk carrying five elongated leaves or petals. It was found in Mesopotamia and was probably cast about 3200 B.C. This and much other fascinating information is printed in the first chapter. Next, the developments in the Far East are dealt with, and the illustrations of Chinese work used to depict the pre-Christian era productions of art castings are often outstandingly beautiful. It was news to the reviewer that the Indians developed cast steel round about 500 A.D., that is, 1,250 years before Huntsman! From the Far East, the next chapter (3) takes the reader to the Mediterranean shores, where the history of casting as carried out in Egypt, Greece and Rome is successively covered. About this time, in addition to casting utensils, there was a start made with tables and bath tubs cast in bronze. In Chapter 4 the renaissance period comes under review, and with it the possibility of detailing some of the plant then available. The literature of the founding of bells and guns is quite rich, and the Author must indeed have found it difficult to compress the subject into one chapter. However, it was a surprise to the reviewer to learn that an eighteenth century gunfoundry at Moorfields became a place of worship—the church of John Wesley. In this chapter are included two works of art by Cellini—Perseus and the gold salt cellar.

Under the useful caption "Sand Castings of Direct Blast Furnace Iron," the Author has been able to include information about the early types of iron furnaces and their products, such as fire-backs, stoves, animal statuettes, and filigree fruit bowls. By chapter 7 the sixteenth century is reached and engineering castings, such as pipes, make their appearance. There is a particularly good picture of the Versailles' line installed in 1664 by Wilkinson. In dealing with the treading of clay for the making of crucibles, a caption states that this process was in use as late as the middle of the eighteenth century; actually it is in use to-day in Sheffield.

One of the most interesting chapters is the one dealing with the Colonial Foundries in the New World. The first one, it seems, went out of action owing to the massacre of the staff by the local Red Indians. The second attempt was more successful, and the book carries an illustration of the first casting ever made. It is a gipsy pot and was made in Lynn in 1642. The last chapter is on foundry mechanisation and herein is an unfortunate spelling mistake, as Dr. Sorby's name is printed as Sarby. In the index, also, there is a second mistake, which is all too common—that of "Hatfield" for "Hadfield." The illustrations of mechanised foundries of 50 years ago serve to remind one that this system is by no means novel. Quite a few items of standard foundry equipment were originally developed in this country, to which fact the Author pays his tribute. Moulding machines are, however, predominantly American. The book is well indexed and readers who can acquire a copy can indeed count themselves fortunate.

V. C. F.

Notes from the Branches

East Midlands—Lincoln Section

There was an innovation in the programme for the second meeting of the session held last month in the Technical College. It took the form of a Brains Trust *cum* Quiz. Mr. A. Swain presided and Mr. V. C. Faulkner, Editor of the FOUNDRY TRADE JOURNAL, acted as Question Master. The latter opened the evening by a short talk on "*That's* My Business," wherein he outlined the activities of an Editor of a technical journal in relation to the industry serviced. Outstanding amongst the subjects discussed were youth recruitment, Sand-slinging methods, standardised patterns and where is the major need for mechanisation. One of the objects of the discussion was to give every opportunity for the shyer members to participate. On this count the evening was remarkably successful, for of the 70 or more present quite a good percentage "took the floor." Moreover, the discussion was at a high level. The progress made by the section in recent years is noteworthy.

Wales and Monmouth

The West Wales Section of the Wales and Monmouth Branch held its third meeting of this session in the Landore Steel Works, the birthplace of the Siemen's open-hearth steel furnace. The inventor—then Dr. Siemens, living in a house in the works which still stands—made international history with his invention. Here the Section heard a lecture by Mr. J. Blakiston, of Halifax, on "Mechanical Aids to Coremaking," which was much appreciated. The talk was illustrated by many slides picturing various methods of sand and core conveying—the sand from mixers to coremakers; the cores to ovens; then to moulders. The lecturer advised the adoption for use in jobbing foundries of some of the methods of jigging, grinding and inspection of cores as now used in highly mechanised foundries. Many errors and misfits would thus be avoided. Warning being given also of the disease known as "coreitis"—the use of cores without need, to construct a mould. This lecture was also given in Cardiff on November 6.

Developments in American Foundry Equipment

General-purpose Production Machinery and Methods

By W. A. Turner

Any review of developments in the American foundry equipment and supplies industry always sharply outlines the insistence of the American engineer on high production per man-hour and is therefore particularly pertinent in Britain at this time.

Moulding Equipment

The main recent innovation in the field of moulding equipment has been made by Beardsley & Piper with the introduction of a new type of Sandslinger termed the "Hydra-Slinger," and shown in Fig. 1. This machine, which has been specially designed for use in moulding units where the moulding box and pattern move into the ramming area on a turn-table or other such device, is primarily of the familiar type except that the arms carrying the ramming head are moved hydraulically, the movement being controlled by means of a joy-stick remote from the machine itself.

The head follows the movements of the joy-stick quite faithfully, the stick itself pivoting about its base so easily that it can be operated by a woman for long periods without fatigue. This factor is not important in large American foundries, where there is no wage differential between the sexes, but it is an added attraction in this country. The area covered by the ramming head is a little more restricted than in the case of the conventional type of Sandslinger, but the Hydra-Slinger will take a moulding box of 5 ft. × 7 ft. maximum size. Sitting on a stool adjacent to the control box, the operator can see the head through all its movements, and control it just as closely as if he were manually propelling it.

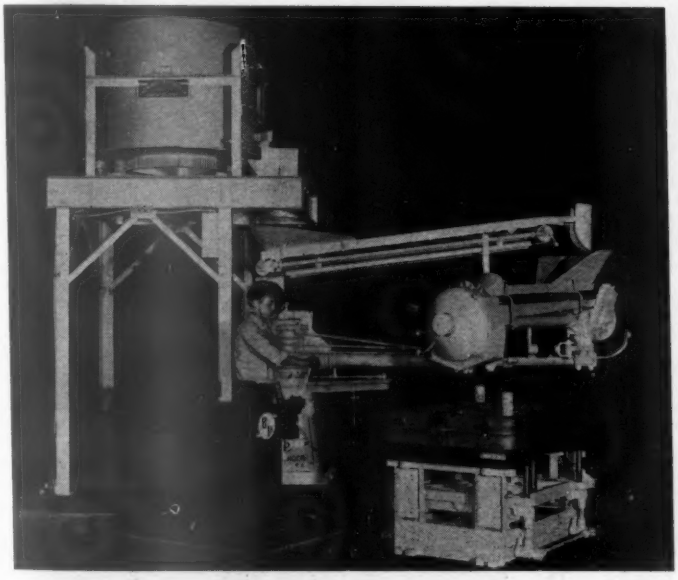


FIG. 1.—SANDSLINGER UNIT EMBODYING JOY-STICK CONTROL.

Castings Cleaning Equipment

It is only natural that an attempt should have been made to achieve continuous shot-blasting, and the machine illustrated in Fig. 2 is that designed for the purpose by the American Wheelabrator and Equipment Corporation. Castings are fed, usually by slat conveyor, into the hopper at the left-hand end of the machine; they proceed from left to right across one of the familiar endless-apron type of conveyors which is slightly inclined from the horizontal, and are then discharged from the bottom right-hand corner of the machine, either on to a conveyor or into work pans after having been cleaned during their passage by the centrifugal projection of shot on to their surfaces. To cope with work of different sizes which require a shorter or longer cleaning time, both the angle of inclination of the conveyor and the speed of the apron can be varied. The same systems of shot re-circulation and dust extraction are used as in the conventional, batch-type, Wheelabrator.

Core-making Equipment

A new addition to the already wide range of American core-blowing machines has been made by the Redford Iron & Equipment Company, of Detroit, in the form of what is termed a "cartridge-type" core-blower, suitable for cores up to 2 lb. in weight. This machine is quite different from the English cartridge blower, as will

Developments in American Equipment

be seen from Fig. 3, the main difference being that the cartridge and blowing head are detached manually from the appliance after each blow; the cartridge is filled by jabbing its open end into a heap of sand on the bench, the head and cartridge then being mounted on top of the corebox which is to be filled. The blowing tube of the machine is pulled down by means of a rack and pinion mechanism on to the full cartridge for the next shot.

The core blower is a bench-mounted machine taking up very little space, and is easily moved from place to place. A standard range of blowing heads is available from 3½ in. square to 14 in. × 3½ in., so that the most convenient size can be used with each corebox; this arrangement has the advantage that the plate on the blowing head can be drilled with any number of holes so that profile blowing is achieved. The separate blowing head and cartridge tube mean, moreover, that a change in coreboxes can be accommodated immediately without the necessity of waiting while fixed blowplates are changed. As to the speed of the machine, it is worth recording that three women in a Continental foundry were turning out trench-mortar bomb cores at the average rate of 360 per hr. from one of these blowers without any difficulty. It is understood that this machine will be on sale next year in this country.

Another interesting item of core-shop equipment is the high-frequency drying oven (Fig. 4) which is now being turned out as a standard unit by The Induction Heating Corporation of Brooklyn. The oven is of the continuous type and consists of a box 10 ft. × 4 ft. 4 in. × 6 ft. 8 in. in height, housing a horizontal conveyor which stands 3 ft. above the ground. A loading table 4 ft. 9 in. long projects from the loading end, and a platform 2 ft. long from the discharge end. As with the conventional type of stove, the length of the drying cycle is directly proportional to the size of core, the drying time in this case, however, being measured in minutes instead of hours. In the size of oven mentioned above, a 25-lb. core in the form of a cube can be completely dried in 3 min., but pipe fittings and small cores for automotive parts can be dried in 2 to 2½ minutes. When one realises that the cores rarely rise above a temperature of 200 deg. F., it will be obvious that handling and cooling are no longer problems and that the planner's job is considerably eased by the shortening of the time factor. It should be noted, however, that the plastic core binders which must be used are not yet in great supply in this country, and the special compound said to be necessary for the manufacture of shell dryers is still held under an American patent.

Sand-preparation Equipment

Beardsley and Piper are responsible for two sand conditioning machines which are of interest in that they provide means for the treatment of large quantities of backing sand without the necessity of returning it by conveyor to a fixed point in the foundry. The "Junior Nite-Gang" (Fig. 5) and the "Preparator" are similar in their functions, the former having a

FIG. 2.—CONTINUOUS SHOT-BLASTING MACHINE.

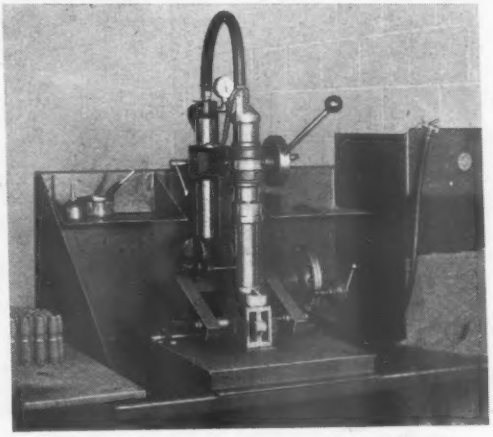


FIG. 3.—CARTRIDGE-TYPE CORE-BLOWER.

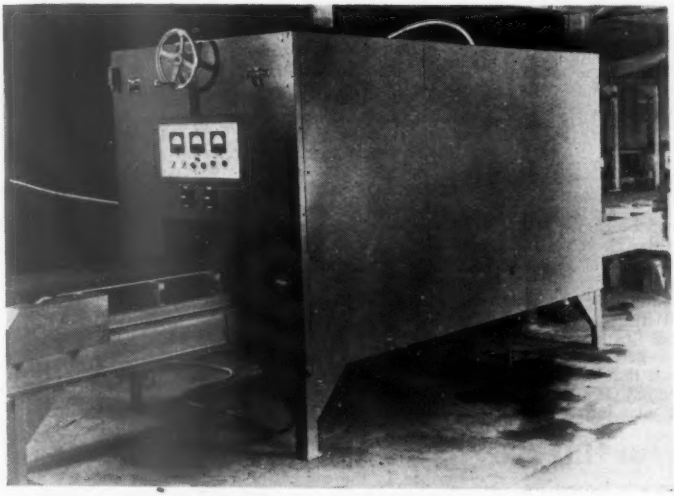


FIG. 4.—HIGH-FREQUENCY CONTINUOUS OVEN FOR CORE-BAKING BY INDUCTION.

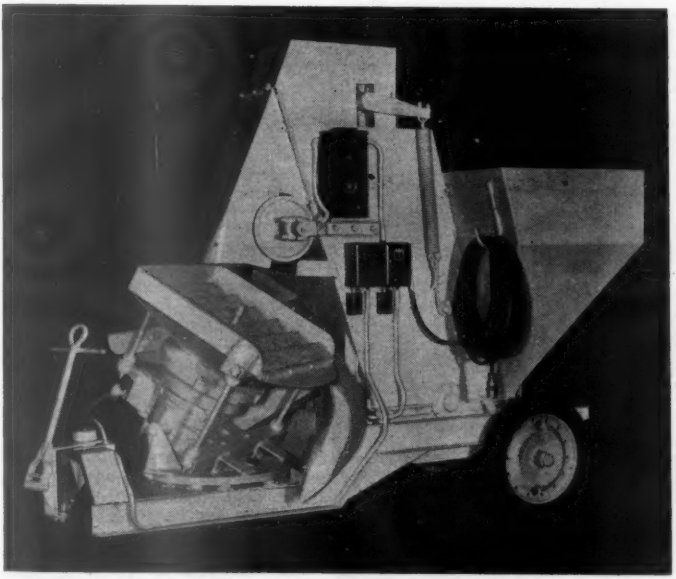


FIG. 5.—PORTABLE SAND-CONDITIONING MACHINE FOR LARGE AMOUNTS.

capacity of 20 tons per hour and the latter 60 tons per hour; both are transported to the sand, the Preparator by crane and the Nite-Gang on wheels. In the use of the latter machine, the sand is fed into the hopper at the rear, then passes over a magnetic separator and finally through a Screenarator. The larger machine, the Preparator, carries out the same operations except that an aerator is substituted for the Screenarator and a water spray is added at the discharge end; anticipating its adoption in foundries making large castings, a separate lump-breaker is also included in the Preparator.

Chemically-bonded Sand

The most revolutionary new feature of all is not a machine or piece of equipment, but a bond for moulding sand. This is a thermo-plastic hydrocarbon called "Westonite" which is milled and dried on to the sand so that each grain of sand is coated with the synthetic bond and thus completely isolated from the molten metal. The claims made for sand treated in this way are:—(1) That burning-in and scabbing are almost completely eliminated. (2) That no coal dust and only half the normal clay and moisture additions are necessary to the coated sand to achieve comparable physical properties. (3) That, due to the low moisture, a finer and less permeable sand can be used, giving a very smooth surface finish. (4) That the sand possesses two qualities, *i.e.*, toughness and flowability, hitherto considered incompatible. (5) That the vertical and horizontal faces of a mould are of very nearly the same hardness and that swelling in the castings is greatly reduced. (6) That the casting strips much more easily from the mould, the sand adhering so loosely to the surface that cleaning costs are considerably reduced. (7) That a larger range of castings is possible with one sand than with conventional sands, *e.g.*, the same sand is used for iron casting ranging between a few ounces and four tons, both large and small moulds being cast green.

So far, Westonite has not been used with metals having a higher melting point that cast iron, but it

Developments in American Equipment

is being used satisfactorily in more than twenty mechanised foundries in America. Some initial troubles with core-sand additions appear to have been overcome, and it is said that the process can be operated as cheaply as a normal Bentonite-bonded, synthetic sand. Certainly the castings available for inspection are of a superlative surface finish and the comments of users are mainly laudatory.

Conclusions

What over-all impressions, if any, can be gained from such a brief review? For many years the United States has been regarded as the home of special-purpose equipment suitable mainly for mass-production. Of the machines mentioned, only the Hydra-Slinger could be regarded in this light, although the continuous Wheelabrator must be somewhat less flexible than a batch-type machine. However, the general-purpose applications of these machines are such that they must obviously have an appeal for this country at this time when increased production is of such vital importance.

New Die-casting Foundry at H.D.A.

The re-equipment of one of the world's largest and best equipped gravity die casting foundries for the production of "Hiduminium" die castings has just been completed by High Duty Alloys, Limited, at their Slough works.

Metal is prepared for casting in semi-rotary bulk-melting furnaces supplied by Ashton, Limited, and these in turn serve batteries of bale-out furnaces, supplied by the Morgan Crucible Company, which are

(*Concluded at foot of col.* 2.)

An Unusual Waster

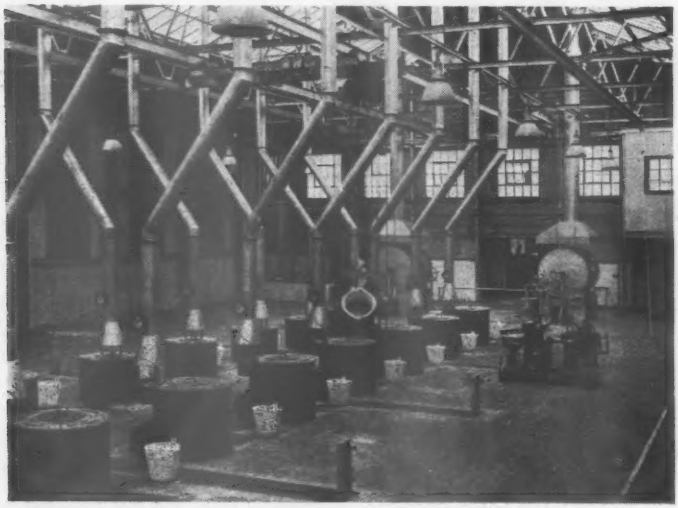
"By Coroner"

The use of light steel boxes for greensand work has become quite popular with jobbing foundries, yet their use for occasional drysand jobs may be the cause of a waster unless care be exercised. A recent experience illustrates this. A job which was required to be exceptionally sound, and to be machined extensively, was required urgently, and it was decided to cast it in dry sand to ensure its being a good casting. The mould was duly rammed, dried and assembled for casting, the moulding box used being of the type previously mentioned, and the two halves clamped together prior to pouring.

Mould Shrinks in Drying

In all the greensand work of a similar nature these clamps had been sufficient to guard against lift, but in this particular case the job turned out defective, as the joint parted and made the top half too large. It was subsequently found that the cause of this defect was that the moulding box had smooth sides, and the difference in the expansion of the sand and the metal box during drying was sufficient to cause a slight gap between the two. When the force due to the ferrostatic pressure became effective, the top portion of sand floated, although the metal box-parts were still clamped firmly together.

The remedy for this defect in subsequent castings of a similar nature was to place a loose weight on top of the sand part of the mould, thus making certain that it would not lift.



used mainly for holding and material cleansing before casting. "Hiduminium" alloys are transferred from the melting furnaces to the holding furnaces by means of electrically-operated cranes and tilting ladles. Particular attention has been given to furnace control both from the point of view of pyrometrical equipment for temperature recording, and gauges which enable efficient control of furnace firing.

Care has been taken in the lay-out to ensure that the fettling shops are adjacent to the die casting foundry, to facilitate the easy flow of castings from the dies to the final inspection department. A floor has been provided with all the services in underground trenches. These trenches have been covered, so as to be flush with the floor, by using cast aluminium-alloy chequered plates,

Manufacturers' Organisations Oppose Steel Bill

An Impediment to Recovery

Statements on the Iron and Steel Bill have been issued by the Federation of British Industries and the National Union of Manufacturers. Both organisations emphasise the point that the measure will aggravate the nation's economic difficulties.

"The outstanding impression left by this Bill is that it provides no practical plan or programme of action," states the F.B.I. "The scheme to take over the share capital of the 107 major steel-producing companies, while in theory preserving the present management structure of the industry, has every appearance of a facade to conceal the absence of constructive thought. The Bill can do nothing to assist the economic recovery of this country and is likely gravely to impede it by creating doubt and dislocation. The steel industry is showing outstanding achievement and efficiency, accompanied by sound labour relations. Its products are competing successfully and substantially in the export markets of the world. It has voluntarily co-operated in a scheme of public control exercised through the Iron and Steel Board. There is no evidence that the drastic changes of ownership proposed under this measure would benefit producers, consumers, workers or the nation.

"The terms for the acquisition of the securities of the companies are based on Stock Exchange prices. These have been depressed by the voluntary limitation of dividends, willingly accepted by the industry in the public interest, at the request of the F.B.I., and unfair advantage is being taken of this. In addition, share values have been further affected by the fear of impending nationalisation. The Government seeks in this Bill powers far in excess of those obtained in any previous nationalisation measure, yet the intentions are less precisely defined. By the acquisition of the major iron and steel companies and their subsidiaries, nationalisation would for the first time enter the field of competitive manufacturing industry on a wide scale.

Interests of the Consumer

"No duty is placed upon the projected Iron and Steel Corporation to produce efficiently at the lowest cost, and indeed the interpretation of its obligations in the public interest is left to the Corporation itself. No direction is given to the Corporation to be impartial in the distribution of its products or to avoid preference in its price schedules. The provisions for safeguarding the interests of the consumer are more vaguely worded than in any previous nationalisation Act, and the whole of this important matter is left to be settled by the Minister through the making of regulations. For these reasons the Grand Council of the Federation is completely opposed to the Bill."

Sir Frederick Bain, president of the Federation of British Industries, issued the following statement last week:—

"There have been many references in the Press to the effect of the plan for the voluntary limitation of dividends upon the proposed level of compensation in the Iron and Steel Bill. I feel it necessary to state that during the interview which my colleagues and I had with Sir Stafford Cripps last March, when the voluntary plan was presented to him, we made specific reference to this question and drew attention to the inequity that would arise if in any future nationalisation schemes Stock Exchange valuations were used as a basis for compensating firms who had voluntarily limited their dividends.

"The Chancellor of the Exchequer noted this point. My colleagues and I could not at that stage expect more, as the question was at that time hypothetical. Now that action is proposed, the point has been completely ignored. It is small encouragement to public-spirited co-operation in voluntary action to find the Government taking advantage of it in this way. It is to be hoped that in the Parliamentary discussion of the measure a greater sense of fairness may prevail."

The National Union of Manufacturers says that it has given careful consideration to the provisions of the Iron and Steel Bill "with a view to seeing whether the introduction of this measure will increase the ability of British industry to manufacture and export." The statement continues: "As far as the Union is aware, the promoters of the Bill have not attempted to show that at the present time it will increase production, add to efficiency or lower costs in the iron and steel industry. As the facts clearly prove, the industry is giving a vital and efficient service to the country in the shape of increasing output at prices which compare very favourably with those of other steel-producing countries.

"The economic difficulties that this country has to overcome during the next few years are very great, and, in the view of the Union, the Iron and Steel Bill will aggravate these difficulties by introducing an unfortunate element of uncertainty into the iron and steel industry and in those industries dependent upon it which must retard progress and reduce their effectiveness during these vital years. There is another aspect of the Bill upon which the Union feels bound to comment. The Union was a party to the voluntary agreement by industry for the limitation of dividends, and feels strongly that, in the light of that agreement, the basis of compensation laid down in the Bill for the securities of the companies which it is proposed to acquire, cannot be justified on any grounds of equity. In this respect the Bill is, in the opinion of the Union, a blow to savings, to investment and consequently to industrial development. For these reasons the Union is strongly opposed to the Bill."

IN HIS WILL, which was proved recently, Mr. John James Swain, late chairman of Matthew Swain, Limited, cast-iron hollow-ware manufacturers, of Newton Heath, Manchester, left a week's wages to every employee.

Company News

(Figures for previous year in brackets.)

Alvis—Dividend of 6% (5%).

Stancroft—Interim dividend of 15%.

Associated Fire Alarms—Dividend of 4% (same).

Gerrard Industries—Interim dividend of 10% (same).

Johnson & Phillips—Interim dividend of 7½% (same).

Beeston Boiler Company—Interim dividend of 10% (same).

Ward & Goldstone—Interim dividend of 20% (same).

J. Stone & Company—Interim dividend of 10% (same).

Hattersley (Ormskirk)—Interim dividend of 6% (same).

Tube Investments—Final dividend of 12½%, making 25% (same).

Hackbridge & Hewittic Electric—Interim dividend of 4% (same).

John Dale—Interim dividend of 7½% (single payment of 20%).

Whitehead Iron & Steel Company—Interim dividend of 12½% (same).

John Rigby & Sons—Final dividend of 5% (7½%), making 10% (same).

B. & F. Carter & Company—Dividend of 10% and bonus of 5% (same).

Cannon Iron Foundries—Final dividend of 10%, making 15% (same).

Joseph Lucas—Final dividend of 12½% (15%), making 17½% (same).

Perry & Company (Holdings)—Final dividend of 7½%, making 10% (same).

British Electric Resistance Company—Final dividend of 15%, making 20% (nil).

Pickford, Holland & Company—Final dividend of 10%, making 17½% (same).

Crittall Manufacturing Company—Final dividend of 10%, making 20% (same).

Brown Bayley's Steel Works—Final dividend of 8%, making 12%, tax free (same).

Walmsleys (Bury)—Final dividend of 10%, making 16% for year (12% for nine months).

Dennis Bros.—Final dividend of 1s. 10d. per share (2s. 2d.), making 2s. 6d. per share (same).

Concentric Manufacturing Company—Dividend of 25% on capital of £125,000 (25% on £90,000 capital).

Marshall Sons & Company—Final dividend of 11¼%, making 15% (same). Accounts for the year to September 30, 1948, will be delayed.

John Shaw & Sons, Wolverhampton—Dividend of 10%, less tax (same) and capital bonus of 5%, not subject to income tax, payable out of capital reserve (same).

Engineering & Lighting Equipment Company—The directors have decided that current results do not warrant payment of any dividend on the ordinary and preference shares (same).

Irish Steel Holdings—Profit for the period from June 23, 1947, to June 30, 1948, £4,887; to income tax, £56; interest on purchase consideration, £1,024; interest on bank overdraft, £4,294; forward, £487.

Moss Gear Company—Final dividend of 12½% (same), plus a bonus of 5% (same), making 25% (same). In addition, an extra bonus of 5% (nil) payable out of exceptional profits relative to earlier years.

Specialloid—The board has informed the Stock Exchange that the company is not paying the preference dividend which was deferred on May 15 and also is not meeting the preference dividend due on November 15.

Albion Drop Forgings Company—Trading profit for the year to September 30, £44,388 (£15,088); E.P.T. recoverable, nil (£3,764); to tax, £24,337 (£6,881); leaving £20,051 (£11,971); final dividend of 7½%, making 12½% (same); dividends paid and payable, £10,313; forward, £28,851.

Smith-Clayton Forge—Trading profit to July 31, after £15,957 depreciation of fixed assets, £92,067; other income, £1,146; to tax, £49,734; leaving £43,479; brought in, £149,870; to general revenue reserve, £30,000; preference dividend, £2,063; ordinary dividend, £13,200; forward, £148,086.

Walter Spencer & Company—Profit to September 30, after directors' remuneration, depreciation, etc., £24,881 (£18,394); E.P.T. refunds, £3,960 (nil); to profits tax, £5,000 (£1,500); income tax, £6,000 (£9,000); final dividend of 10%, making 15% (same); general reserve, £5,000 (nil); deferred repairs, £2,010 (nil); forward, £7,640 (£5,059).

Horseley Bridge & Thomas Piggott—Income in the year ended June 30, £149,522 (£148,210); to depreciation, £21,968 (£21,000); directors' remuneration, £12,102 (£13,429); tax, £62,100 (£50,000); net profit, £53,352 (£63,781); brought in, £101,152 (£68,771); dividend of 15% (same); benevolent fund, nil (£500); general reserve, £30,000 (nil); forward, £98,104.

Redpath, Brown & Company—Income in the year ended July 31, £619,282; to directors' emoluments, £11,626; auditors' remuneration, £853; depreciation, £30,000; tax, £329,407; profit, £247.396 (net profit, £96,470 after tax); brought in, £172,244; to preference dividend, £5,775; dividend on ordinary shares, tax free, £241,621 (£90,695); forward, £172,244.

Thomas Harrington—Trading profit to June 30, £44,081 (£33,113); tax on profits, £24,583 (£17,866); preference dividend, £1,375 (£1,079); ordinary dividend of 45 per cent., £7,425 (same); general reserve, £5,000 (nil); tax on balance of past profits, £2,777 (nil); deferred repairs, £1,500 (nil); expenses of conversion to public company, etc., nil (£1,905); forward, £22,483 (£21,062).

Martin Bros. (Machinery)—Trading profit to June 30. £28,097 (£27,140); gross income and profit on sale of investments, £1,794 (£2,012); to depreciation, £678 (£664); directors' remuneration, £5,118 (£5,126); tax, £14,200 (£9,537); net profit, £9,895 (£13,825); provision for price adjustment claims not required, £2,500 (nil); to future tax reserve, £1,000 (£2,000); dividend of 12½% and bonus of 5% (same); forward, £36,773 (£32,597).

Plessey Company—Net profit for the year ended June 30, after depreciation, etc., but before taxation, £117,971 (£190,126, including a dividend from subsidiary out of taxation reserve no longer required £114,157); to tax, £53,205 (£30,000); preference dividends, £25,135 (£12,330); final ordinary dividend of 10%, making 20% (same dividend, but also 5% capital distribution last year); general reserve, nil (£97,625); forward, £84,815 (£72,684).

Lightalloys—Net profit for the year ended June 27, before directors' remuneration, depreciation and tax, £35,394 (£14,510); to directors' fees, £1,800 (same); directors' salaries and other emoluments, £5,987 (£5,327); depreciation, £6,384 (£6,188); leaving £21,223 (£1,195, plus £15,000 E.P.T. recoverable for 1946); E.P.T. recovered, £5,272 (£3,287); to tax, £13,750 (£7,500); final dividend of 10%, making 15% same); forward, £2,845 (£2,082).

Warne, Wright & Rowland—Group profits for 1947, after charging all expenses, maintenance of buildings and plant, depreciation, directors' emoluments and making provision for taxation on the profits to date, £38,894; adjustments in respect of previous years, £1,318, making £40,212 (this includes 15 months' trading for two subsidiaries). No comparable figures are available for 1946 owing to the date of acquisition of a major subsidiary company. Parent company's profits (including adjustments for previous year), £21,795 (£21,793).

Carrier Engineering Company—Trading profit to June 30, £167,959 (£157,039); to directors' emoluments, £16,000 (same); audit fee, £525 (same); patent fees and charges, £1,373 (£1,136); depreciation, £7,055 (£5,454); deferred repairs, nil (£4,000); written off investment, nil (£1,000); leaving £143,006 (£128,924); investment income, £4,936 (£4,578); depreciation on property sold, written back, £1,625 (nil); sale of furniture, nil (£2,462); to tax, £75,593 (£57,847); leaving £73,973 (£78,117); to staff pension, nil (£10,000); dividend of 35% (same); forward, £254,780 (£187,013).

Smith's Stamping Works (Coventry)—Trading profit to July 31, after £7,119 depreciation of fixed assets, £33,745; subsidiary dividends, £27,750; rents, £53; fees, £8; sale of surplus assets, £2,122; to tax, £29,102; leaving £34,576; to general revenue reserve, £22,079; dividend of 10% (same); forward, £61,671. Trading balance for period from August 4, 1946, to August 2, 1947, £8,777, after depreciation and tax and bringing in E.P.T. recoverable of £38,000; fees, £13; subsidiary dividend, £10,378; to directors' fees, £900; leaving £18,268; to dividend, £13,750; forward, £62,925.

Platt Bros. & Company (Holdings)—In accordance with previous announcements, the directors have decided to close the accounts in future on December 31 instead of March 31. Therefore, the current financial period will be one of nine months ending on December 31 next. This change has been made to bring into line the financial years of the company and its subsidiaries in compliance with the requirements of the Companies Act, 1948. Consequent upon the alteration in the financial year it has become necessary to make changes in the dates of payments of preference dividends.

Wallis Tin Stamping Company—Trading profit to June 30, £166,630 (£74,808); transfer fees, £23 (£51); interest receivable, £289 (nil); rent receivable, £288 (£23); to directors' fees, £300 (same); salaries as executives, £7,964 (£7,879); share of profits, £11,575 (£4,679); key employees' share of profits, £6,384 (£1,970); depreciation, £16,979 (£9,788); audit fee, £529 (£405); removal and reinstatement expenses, £1,662 (£608); leaving £121,837; to taxation, £67,148 (£18,703); preference dividend, £2,475 (£2,470); final dividend of 33⅓% (same), making 66⅔% (40⅝%); forward, £45,064 (£21,725).

Serck Radiators—Consolidated trading profit from August 3, 1947, to July 31, 1948, £229,864 (£168,293); property revenue, £1,237 (£1,481); transferred from deferred repairs, £14,247 (£10,557); fees, £13 (£20); to tax, £105,000 (£62,470); depreciation, £16,498 (£15,107); replacement and obsolescence reserve, £2,500 (£2,000); directors' fees, £2,850 (same); directors' other emoluments, £16,926 (£13,465); audit fee, £1,000 (same); staff pensions and life assurance, £6,947 (£955); leaving £93,640 (£82,504); tax provision no longer required, £30,000 (£22,000); to final dividend of 20% (25%), making 30% (30%, including 5% bonus); staff pension provision, £20,000 (nil); general reserve, £25,000 (£50,000); contingencies reserve, £45,000 (£10,000); forward, £41,178 (£40,538).

Birmingham Small Arms Company—Group's trading profit for the year ended July 31, £1,146,383 (£654,490); dividends from trade investments (including £100,142 from profits of previous years), £125,107 (£24,680); miscellaneous income, £26,559 (£23,375); E.P.T. recoverable, nil (£226,324); to depreciation, £334,171 (£319,643); debenture interest gross, £50,178 (£51,958); directors' remuneration, £19,592 (£16,012); auditors' remuneration, £3,420 (£3,249); premiums on debentures redeemed, £1,058 (£1,014); tax, £460,000 (£233,677); provision for equalising tax allowances, nil (£85,348); net profit, £429,630 (£217,968); attributable to outside interests, £582 (£1,697); undistributed income of subsidiary, £17,850 (£26,100); net income, £411,198 (£245,765); dividend of 7½% (same); reserve, £238,219 (£40,722); forward, £247,996 (£208,299).

Cornercroft—Consolidated trading profit for the year to June 18, £63,812 (£56,794, plus reserves from previous years no longer required £25,374); dividends and interest, £1,338 (£489). (Accounts include those of one subsidiary for the period March 1, 1947, to June 18, 1948, which ceased trading on April 30 and incurred a trading loss of £1,730 for the two months ended at that date.) To depreciation, £7,910 (£11,498); directors' fees, £492 (£683); directors' other emoluments, £8,215 (£10,691); leaving £48,533 (£59,785); to profits tax and income tax, £29,270 (£40,250); parent company's trading profit, £64,943 (£62,540); dividend and interest, £1,106 (£840); to depreciation, £7,910 (£7,177); directors' fees, £425 (same); directors' other emoluments, £8,215 (£7,941); leaving £49,499 (£47,837); to profits tax and income tax, £29,000 (£25,500); general reserve, £6,000 (£7,500); dividend of 9%, making 15% (same); forward, consolidated, £1,088 (£2,277); parent company, £4,765 (£4,718).

Parliamentary

Colleges of Technology

MR. M. F. TITTERINGTON asked the Minister of Education whether it was his intention to implement, without any further delay, the recommendation of the Percy Committee, supported by the Barlow Committee, over three years ago that there should be a selected number of colleges of technology in which there should be developed technological courses comparable with those of university courses; and whether university status would be given to some of these colleges of technology.

In reply, the MINISTER OF EDUCATION (Mr. Tomlinson) said that a Joint Committee of the National Advisory Council on Education for Industry and Commerce and the University Grants Committee had been set up to consider questions of advanced technological education generally, and the points raised by the questioner were receiving attention.

MR. TITTERINGTON: Does not my right hon. friend think that this type of technical colleges situated in the major industries they serve is the quickest and most effective way to meet the current requirements of our industrial progress at the moment; and does he agree, in that regard, that Bradford stands pre-eminent?

MR. TOMLINSON: It is because of the importance of these related questions that the Joint Committee has been set up.

MR. TITTERINGTON further asked if the Minister endorsed the view that, having regard to the difficulties of the building extensions in our existing universities, with the limitations of their hostel accommodation, the quicker and better way was to encourage the smaller universities.

MR. TOMLINSON: Yes, sir, in general I would subscribe to that view.

Future of a Distington Factory

MR. PEART asked the Minister of Supply if he had any statement to make on the future of High Duty Alloys, Limited, factory, Distington, Cumberland.

In reply, MR. STRAUSS said that this privately-owned factory was extended and additional plant installed during the war at Government expense. The extension and part of the plant had now been sold to the owners, High Duty Alloys, Limited. His information was that only part of the factory would be needed for aluminium fabrication, owing to the reduced civilian demand, and the remainder would be let for other manufacturing purposes, if a suitable tenant could be found.

MR. PEART then asked if the Minister was aware that the paying off of skilled workers recently was causing concern in that area and would he be prepared to conduct a local inquiry as to the future of the factory.

MR. STRAUSS said he was aware of what Mr. Peart said, but High Duty Alloys, Limited, had a right of option on the building and, although the company would consult the Ministry as to how it would be used, the Ministry had no authority to intervene.

New Capital for Steel Companies

MR. ERROLL asked the Minister of Supply in what way a steel company might now finance an urgent approved project for which a public issue of new capital would have been made.

MR. G. R. STRAUSS said that all the normal ways of raising new capital were still open to a steel company. The British Iron and Steel Corporation would be liable for all debts to banks or other creditors of those companies whose shares it would acquire, and subscribers to new issues of securities would receive compensation equal to the price of issue.

MR. ERROLL: Does the Minister think that it is very likely the public will subscribe to those new issues?

There was no reply.

Obituary

DR. SAMUEL CLEMENT BRADFORD, formerly Keeper of the Science Library, South Kensington, died on November 13.

MR. SAMUEL M. HOOD, who died recently, was outside engineering works manager of Harland & Wolff, Limited, Belfast.

MR. WILLIAM MCLACHLAN, managing director of Paul & McLachlan, Limited, ironfounders, of Denny, Stirlingshire, died on November 11 at the age of 64.

MR. DONALD MACKINNON, formerly of R. A. Main, Limited, gas engineers, ironfounders, etc., of Falkirk, Stirlingshire, died on November 4 after a long illness.

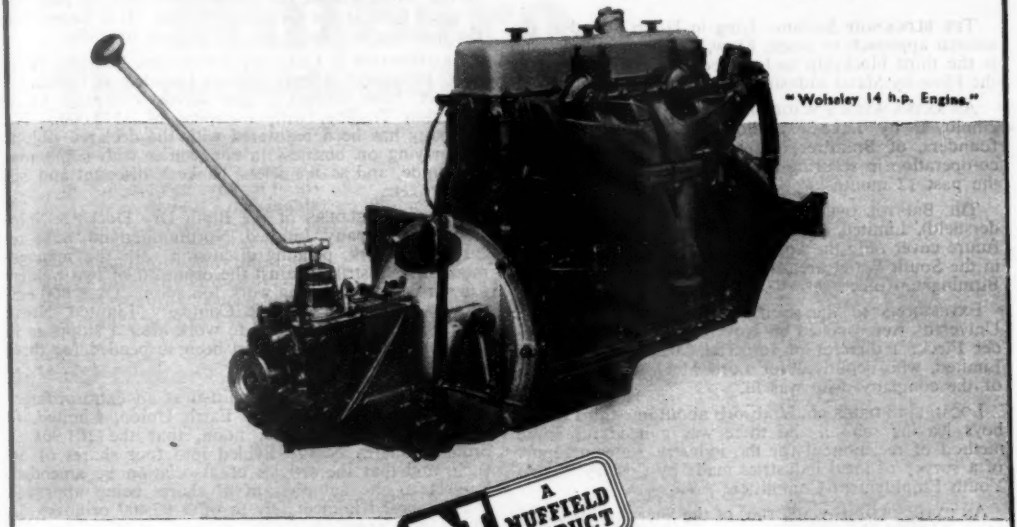
MR. CHARLES SMITH, former shipyard manager of the Caledon Shipbuilding & Engineering Company, Limited, Dundee, died on November 11, at the age of 88.

MR. THOMAS WHITE, managing director of Thomas White & Sons, Limited, woodworking-machinery manufacturers, ironfounders, etc., of Paisley, and a grandson of the founder of the company, has died. Mr. White was also a director of Paisley Technical College and served on the executive of the North-West Engineering Trades Employers' Association.

MR. JAMES MURRAY PRIMROSE, who, until his retirement in 1947, was manager and a director of the Burnbank Foundry Company, Limited, the Camelon Iron Company, Limited, the Grangemouth Iron Company, Limited, and Watson, Gow & Company, Limited, all of which are operated by Federated Foundries, Limited, has died suddenly at Montreal. After his retirement he went to Canada to join his son, who is a medical practitioner in the Dominion. Mr. Primrose entered the service of the Callendar Iron Company, Limited, Falkirk, in 1900, and spent nearly half a century in the ironfoundry industry. He was widely known and took part in many international congresses.

THE ADMIRALTY has placed a contract for the construction of a welding development building at Rosyth Dockyard.

THE ENGINEERS' WORKSHOP and the store of James H. Lamont & Company, Limited, engineers and brassfounders, of Edinburgh, were damaged by fire on November 14.



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News in Brief

THE BLOCKSHIP Soriano, lying in Holm Sound at the eastern approach to Scapa Flow, has been raised. She is the third blockship to have been raised this year in the Flow by Metal Industries, Limited, Glasgow.

AN EXTRA WEEK'S WAGES has been paid to all workers employed by Lake & Elliot, Limited, engineers and founders, of Braintree, Essex, in recognition of their co-operation in securing a record production figure for the past 12 months.

THE BRISTOL OFFICE of David Brown & Sons (Huddersfield), Limited, gear cutters, engineers, etc., will in future cover only the South-Western counties, its duties in the South Wales area having been transferred to the Birmingham office.

EXTENSIONS to the science laboratories of Durham University were opened on November 9 by Dr. Alexander Fleck, a director of Imperial Chemical Industries, Limited, who deputised for Lord McGowan, chairman of the company, who was ill.

LOCAL FOUNDRIES could absorb about one-third of the boys leaving school, and there was a need for some method of recruitment for the industry, states a report of a survey of local industries made by Coseley (Staffs) Youth Employment Committee.

AN EXTRA-ORDINARY MEETING of the Sheepbridge Company, Limited, has passed unanimously the capital rearrangement plan which is necessary for the segregation of the company's engineering, etc., assets in anticipation of iron and steel nationalisation.

A ONE-DAY STRIKE was held on November 15 by 350 workers of John Fowler & Company (Leeds), Limited, agricultural machinery manufacturers, etc., over a wages dispute. The return to work was decided upon pending the outcome of further negotiations.

A CONTRACT FOR THE supply and installation of steel oil-storage tanks and pipelines in the Middle East has been secured by the Motherwell Bridge & Engineering Company, Limited. The company intends to place orders valued at £50,000 for the necessary plant with firms in Motherwell and Lanarkshire.

SHELL-MEX & B.P., LIMITED, has announced reductions in fuel oil prices below the maximum prices authorised by the Government on November 1. These reductions, effective from November 16, are as follow:—Heavy fuel oil, ¾d. per gall.; fuel oil, ½d. per gall. The prices of gas/Diesel oils remain unchanged.

THE OFFICES of the British Association of Used Machine Tool Merchants are now at West India House, 96-98, Leadenhall Street, London, E.C.3 (telephone: Mansion House 7058). Mr. C. W. Allen, who has been appointed full-time secretary to the Association, succeeds Mr. P. S. Gale, of 103-105, Old Street, London, E.C.1.

FOLLOWING THE FORMATION of the new company, Aveling-Austin, Limited, in which Aveling-Barford, Limited, Grantham, and the Austin-Western Corporation, Illinois, are jointly interested, a prototype of a 10-ton power grader for use for road-making purposes is to be built at the Grantham works. It is hoped that the machine will be in full production by 1950.

BRAITHWAITE & COMPANY ENGINEERS, LIMITED, Newport, Mon, and Robert Benson Lonsdale & Company, bankers, have formed a new private company, Compensation Trading, with a capital of £110,000. The company has been registered with the declared objects of carrying on business in connection with compensation trade, and as financiers, bankers, discount and bill brokers, etc.

SEVENTY WELDERS of the Blyth Dry Docks & Shipbuilding Company, Limited, Northumberland, have returned to work, pending discussion with the management, after a strike against the dismissal of two welders for persistently finishing work too soon. Over 600 employees of Smith's Dock Company, Limited, North Shields, have also returned to work after a stoppage in support of a burner who had been suspended for three days.

RESOLUTIONS will be submitted at an extra-ordinary general meeting of Fullers' Earth Union, Limited, to be held on December 6, noon, that the 101,908 £1 ordinary shares be sub-divided into four shares of 5s. each, and that the articles of association be amended. Subject to the sub-division of shares being approved it is proposed immediately to offer 92,400 ordinary 5s. shares at a premium, in the proportion of six new for every five £1 held on November 25. Treasury consent has been obtained for the proposed issue.

Ipswich Bellfoundry Closed

The bellfoundry in Wykes Bishop Street, Ipswich, which was founded nearly a century ago, has closed down and is to be demolished. Mr. Henry Bowell, the founder, visited nearly 800 churches in 25 counties. In 1894 his son, Alfred, took over the business, and two years later, when only 22, began casting his first bells, although he had never seen one made. His original product is still in use at Old Newton Church. Stimulated by this success, he cast five bells for Mistley new church, made the oak framework for them, and transferred the bell from the old church.

The foundry has been closed because of the ill-health of the present owner of the business, Mr. Frederick Bowell, grandson of the founder. Thus will end Ipswich's old industry of bell-hanging and bell-casting, made famous by John Darbie, who cast his last bell in 1685. Owing to limited space, the heaviest bell cast at the works was the tenor for Turvey Church, Bedfordshire, which weighed 19¼ tons. Another bell, also a tenor, made for Dennington Church, ran it close at 19 tons. The firm has cast well over 400 bells, and has restored others in many counties. The last bell made was the tenor for Doddington Church, near March, in January, 1939, but owing to difficulties caused by the war it was not hung until after the second Mr. Bowell's death.

The Mulbaro

The *portable* mullor

THIS all-purpose mullor fulfils the specific mulling needs of all types of foundries. It consists of a detachable mulling unit mounted on a wheelbarrow. Power-driven rubber-tyred mullors mix, mull, and aerate the sand thoroughly; then the wheelbarrow is used to take the mulled sand where required.

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Personal

MR. ARNOLD DUCKITT has been appointed an additional director of the Moss Gear Company, Limited.

MR. G. ROLAND DAWES has been appointed financial director of the Concentric Manufacturing Company, Limited, capstan workers, of Birmingham.

MR. H. C. CLARKE, works manager, has been appointed a director of B. O. Morris, Limited, manufacturers of grinding machines, etc., of Birmingham.

MR. F. S. BEALE, secretary of the English Steel Corporation, Limited, Sheffield (which position he will continue to hold), has been appointed a special director of the company.

MR. H. O. RIGG, of the Suffolk Iron Foundry (1920), Limited, Stowmarket, has been elected a committee member of a newly formed sub-area of the Traders' Road Transport Association, Limited.

MR. R. S. SILVER, a director of research with Federated Foundries, Limited, Glasgow, has been awarded the William Jacks prize by Glasgow University for a thesis submitted in 1945, when he obtained his D.Sc.

SIR ANDREW LEWIS, of John Lewis & Sons, Limited, shipbuilders and engineers, who is retiring from the Aberdeen Harbour Board, will be succeeded on the Board by his son, MR. JOHN A. LEWIS, who is also a director of the company.

MR. R. H. STEPHENSON, general manager of Smith's Dock Company, Limited, North Shields, and MR. J. M. ORMSTON, general manager of Vickers-Armstrongs, Limited, Walker-on-Tyne, have been co-opted to the Tyne Improvement Commission as shipowners' and traders' representatives.

MR. THOMAS TROTT, former chairman of Thomas Andrews & Company, Limited, steel manufacturers, of Sheffield, has received a presentation following his retirement after 50 years' service with the company. MR. GEORGE H. JARRAMS, who joined the company 43 years ago, has been appointed joint chairman and managing director.

MR. A. J. CATERER has been appointed sales representative covering Scotland, Northern Ireland, Northumberland, Cumberland and Durham, of High Duty Alloys, Limited, Slough. He has been associated with the production activities of the company for several years past. Mr. Caterer will operate from the company's sales office at Winscales, Workington.

MR. ASHLEY S. WARD, for many years chairman of the Ketton Portland Cement Company, Limited, which is closely associated with Thos. W. Ward, Limited, Sheffield, has retired from the board, and MR. FRANK R. STAGG, who has been appointed in his place, now holds the position of chairman and joint managing director. Other changes on the board of the company include the appointment of MR. RAWSON F. STAGG as joint managing director and MR. F. W. ROBINSON, who is also closely connected with the foundry supplies department of Thos. W. Ward, Limited, as a director.

MR. DOUGLAS WILLIAM TURNER, who has been elected to the board of the Midland Bank, Limited, and the Midland Bank Executor & Trustee Company, Limited, is chairman and managing director of Wellington Tube Works, Limited, Tipton, Edward Smith, Limited, manufacturers of iron and steel tubes and fittings, of Tipton, Job Edwards, Limited, manufacturers of tubes and fittings, of Wednesbury, and the Victoria Tube Company, Limited, Tipton. He is also a director of a number of other companies, including W. & T. Avery, Limited, and Wright's Ropes, Limited.

MR. DAVID HUGHES, chief draughtsman of Davies Bros. & Company, Limited, manufacturers of structural ironwork, etc., of Wolverhampton, was entertained at dinner recently by four structural engineering draughtsmen who attributed any success they may have had to the training they received under him. The four former apprentices were Mr. F. J. Brown, chief draughtsman of Edward Wood & Company, Limited, Manchester; Mr. W. J. Purcell, senior structural engineer, Ministry of Works; Mr. D. V. Pike, Aluminium Research Association; and Mr. H. M. Dent, assistant to Mr. Hughes.

MR. FRANK W. DUGDALE, vice-chairman and managing director of S. P. Austin & Son, Limited, Sunderland, has been elected president of the Shipbuilding Employers' Federation, in succession to SIR WILFRID AYRE, chairman and managing director of the Burntisland Shipbuilding Company, Limited. SIR LAWRIE EDWARDS, chairman and managing director of the Middle Docks & Engineering Company, Limited, South Shields, has been appointed senior vice-president, while MR. CHARLES CONNELL, a director of Charles Connell & Company, Limited, Scotstoun, and MR. A. L. COCHRANE, chairman of Cochrane & Sons, Limited, Selby, were appointed vice-presidents of the Federation. MR. R. S. CHIPCHASE, chairman and managing director of the Tyne Dock Engineering Company, Limited, South Shields, and MR. HORACE WILSON, managing director of William Hamilton & Company, Limited, Port Glasgow, were elected chairman and vice-chairman respectively of the conference and works board.

Wills

CROUCH, G. T., a director of Dashwood Engineering, Limited, Penge, London, S.E.20, and other companies £116,544

BERRYMAN, WILLIAM, late chairman of the United Flexible Metallic Tubing Company, Limited, Ponders End, Middx. £32,921

HILL, JESSE, chairman of Jesse Hill, Limited, holding company of Davis & Hill, brassfounders, the Empyrium Welding & Manufacturing Company, Limited, and the Vulcan Meter Company, Birmingham, all of which he formerly owned ... £49,267

WHEN HE WAS ASKED at the annual general meeting of Baldwins (Holdings), Limited, on November 12, if, in the event of Richard Thomas & Baldwins, Limited, being nationalised, it was intended to continue as an investment trust or whether the board would liquidate the company, Sir W. Charles Wright, chairman, said that his view was that liquidation should not be considered until they knew more about the Steel Bill and they should wait and see if the Bill became law. At the moment liquidation could not be considered until they had cleared up taxation liabilities with the Government on matters in respect of periods prior to the merger.

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Raw Material Markets

Iron and Steel

The Government's decision to rescind the Iron and Steel Authorisation for the supplying of iron castings on January 1 next should enable foundries to obtain a better balance in their order-books. But this lifting of control, with its consequent elimination of "M" forms, will not allow of an increased output of castings; better supplies of pig-iron are also necessary to achieve that. Although deficiencies in pig-iron are being narrowed down and scrap is also coming forward in increased quantities, foundries are still working on slender stock margins and in few establishments is there freedom from anxieties about the maintenance of adequate supplies of raw material. Hematite is more freely obtainable than low- and medium-phosphorus grades, but the most marked deficiencies are in the light-castings foundries which operate on high-phosphorus iron.

The heavier imports of steel semis now coming to hand from Belgium are all being absorbed quickly. The anxieties of the re-rollers have been eased, but not wholly overcome. Sheetmakers are still in need of sheet bars; the supply of small billets is persistently short of current requirements and the readiness with which defectives and re-rolling scrap are acquired indicates the constant anxiety to acquire material which can be put through the mills.

For nearly all classes of finished steel product there is an overwhelming demand, and in no branch of the industry is this feature so conspicuous as in the sheet trade. As one order is completed there are two or more to take its place, and buyers are glad to place business even if they have to wait six to 12 months for delivery. The plate mills, too, are heavily overloaded, and if the queues for joists, sections and bars are less impressive, buyers still have to place specifications well in advance of delivery dates. Pressure for heavy steel rails and light rails for the pits is unabated, and there is a strong miscellaneous demand for steel products for shipment overseas.

Non-ferrous Metals

The United States copper figures for October, published by the American Copper Institute, show some decline in comparison with September, but the change is not serious. Production of crude copper was 81,692 short tons, compared with 88,071 tons in the previous month, and refined copper output was 101,436 tons, against 102,976 tons in September. Stocks of refined copper rose from 72,515 tons at September 30 to 76,371 tons at the end of October, while domestic deliveries fell by about 10,500 tons to 112,580 tons. The changes are not of great import and do not suggest any alteration as yet in the trend of events in America. Production of crude copper, it will be noticed. fell short of deliveries by about 31,000 tons, while there was an increase in stocks of some 3,900 tons. This means that about 35,000 tons had to be found to bridge the gap, and it must be presumed that copper from overseas made up the difference. Outside the United States production is, of course, considerably in excess of consumption, and there is a surplus to balance the world account in copper. Throughout the present year, U.S. imports of copper must have been running at not much short of 30,000 tons per month, or perhaps even more, for copper acquired for the Government's stockpile has to be considered.

Zinc figures, released by the American Zinc Institute, show that October production increased by about 6,000 short tons to 70,716 tons. Stocks rose from 41,117 short tons at the end of September to 44,431 tons at October 31. In this country there is a certain amount of anxiety about the zinc situation, although stocks are reasonable. The shipping of concentrates for treatment in Britain has for some time presented certain difficulties and it is to be hoped that no interference with our domestic output will occur. In the U.S. the price of the metal is very firm and business has been done at well above the domestic quotation. This applies also to lead, and it seems as if both these metals might advance in price shortly, for consumers are persistent in their demands and seem prepared to pay almost any figure for supplies. The lead position in Britain is decidedly precarious, for stocks at September 30 were under 20,000 tons and may fall lower. The authorities have a check on lead consumption, by means of the quota system which limits usage quarter by quarter, but, despite this, reserves have fallen rather disastrously during the year. Secondary lead is in fairly good supply.

MR. F. C. EVANS has relinquished his position as general manager to Langley Alloys, Limited.

A NEW AGREEMENT has been reached between the United Patternmakers' Association and the National Light Castings Ironfounders' Federation which will benefit a large number of workers in the Falkirk and Glasgow areas. The agreement provides for a minimum of £7 1s. 6d. for those employed on payment by results, but it is claimed that many men can make more than the minimum.

CHANGES IN export licensing control are made by a Board of Trade Order (S.I., 1948, No. 2473, the Export of Goods (Control) (Amendment) (No. 6) Order, 1948, price 1d.), which comes into operation to-morrow (Friday). Among those goods which will not require export licences after that date are printers' roller composition, domestic enamelled baths and threshing machines. Licences will now be required for beryllium in some forms and further types of scientific equipment.

A NEW LABORATORY BUILDING for metals processing studies is among the projects proposed in a $20,000,000 development programme announced by the Massachusetts Institute of Technology. Half of this amount is required for endowment and unrestricted funds; the balance will be used for new facilities and equipment at the Institute. The proposed metals processing laboratory will be a four-storey structure containing about 70,000 sq. ft. It will include as one wing a building now used for foundry, welding and forging, which will be drastically remodelled.